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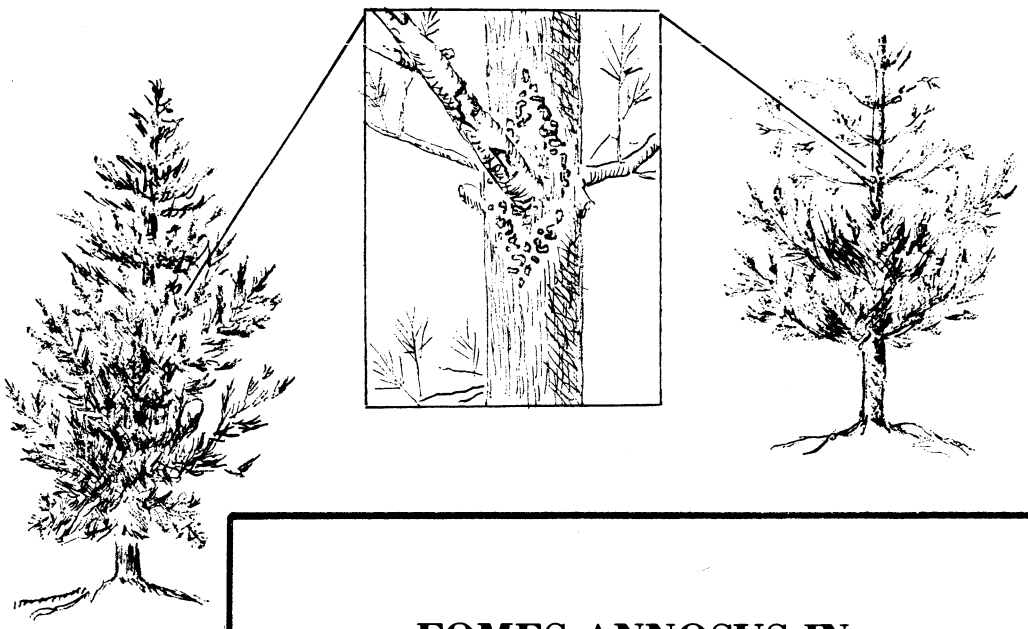
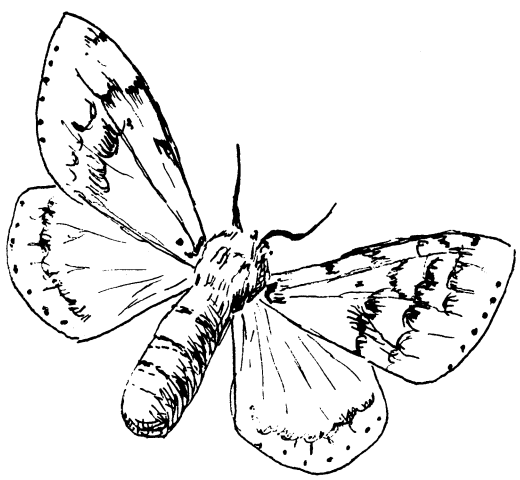
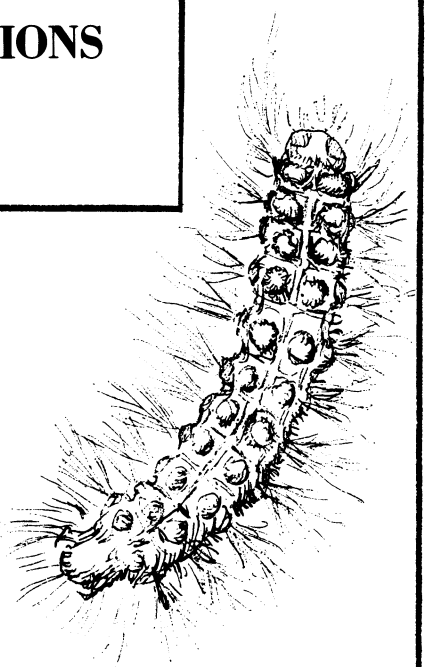


FOMES ANNOSUS IN NEW ENGLAND PLANTATIONS





NORTHEASTERN AREA, State & Private Forestry

Environmental Protection & Improvement Unit, Forest Pest Management Group

FOMES ANNOSUS IN NEW ENGLAND PLANTATIONS

by

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INTRODUCTION

Fomes annosus (Fr.) Cooke was first reported in New England in 1887 at which time it probably caused little mortality. The damage caused by this fungus is characteristically most severe in intensively managed conifer stands. Planting of conifers, especially red and white pines, became widespread in the early 1900's. Several thousand acres were planted in the 1930's and 1940's by the Civilian Conservation Corps. Plantings were followed by thinnings, and as forest management intensified in these stands, so did the prevalence of F. annosus. Today the fungus is common in those areas of New England where thinned plantations are most numerous.

Much research has been done on F. annosus, but relatively little of it pertains specifically to New England. Many biological effects and relationships apply on a broad scale, but more localized factors of probable importance are not well understood. An important but inadequately known element is the amount of damage caused by the fungus in New England plantations. Spectacular losses have been observed in individual plantations, but average mortality rates for a wide range of plantations are not well known. This type of information is often essential to effective forest management, and it assists forest pest management and research agencies in the determination of work loads and priorities.

A New England-wide survey of thinned red pine plantations was conducted during the summer and fall of 1970 to gather data on mortality caused by annosus root rot. Possible influencing factors were also observed and recorded. On lands owned and managed by the Providence Water Supply Board (PWSB) in Rhode Island, the survey included all thinned conifer plantations.

METHODS

Information on the location of thinned conifer plantations was solicited from the New England State Foresters. Specifications for these plantations were:

1. Must be at least 1.5 acres in size.

2. Must have been thinned at least once, but not since 1967.

With the exception of PWSB, the survey was restricted to include only red pine plantations when it became apparent that time would not be sufficient to include all conifer species. Damage is most severe and annosus root rot is easiest to identify in red pine plantations.

All plantations received 100 percent ground coverage. This was possible because average plantation size was only 8.3 acres. Dead trees were tallied by cause of death, either F. annosus or other causes. The presence of F. annosus fruiting bodies was used as the criterion for attributing mortality to annosus root rot. If a dead tree with no fruiting bodies stood adjacent to a tree with F. annosus fruiting, both were assumed to have been killed by F. annosus. No attempt was made to culture the fungus from suspect trees.

Many other items were recorded for each plantation. The land manager provided information on year of thinning, previous land use, whether annosus-killed trees had been removed, and stump treatments for prevention of F. annosus infection. Land managers were asked for information on age and acreage of plantations; age and acreage were estimated by the examiner if the land manager could not provide the information. Items such as plantation vigor, topography, and site moisture condition were recorded after the plantation had been thoroughly covered.

Two 1/20 acre stump/stem ratio plots were established in most plantations. Plot dimensions were 1 chain by ½ chain. In some plantations, plots were not established because the stumps were too decomposed to be located.

Heights of three dominant trees in each plantation were measured with a clinometer. The diameter at breast height (dbh) of five randomly selected trees was measured with a diameter tape. Three basal area readings were made in each plantation with a 10 factor wedge prism. These data were used in making volume estimates.

When reading the ensuing results, pay particular attention to the data from PWSB. All qualifying conifer plantations, regardless of species, were examined on lands owned by this agency. Records kept by PWSB were very complete; exact age, acreage, thinning dates, stump treatments, and frequently the amount of material harvested were available.

RESULTS

One hundred fifty-nine plantations were examined throughout New England. With the exception of Rhode Island, less than half the red pine plantations in each state were surveyed. Practically all the qualifying red pine plantations in Rhode Island were examined.

Mortality was generally light, averaging 2.8 trees per acre in thinned red pine plantations (Appendix - Table 1). It should be emphasized that this is total observed mortality rather than yearly increment. Although average mortality was light, 110 of the 159 (69%) plantations inspected contained annosus-killed trees. In some PWSB plantations, dead trees had been removed if visible from the roadside. These would have raised the average number of annosus-killed trees per acre only slightly.

Mortality varied from state to state. Rhode Island and Massachusetts plantations suffered the most severe mortality. This variation is influenced by a number of factors, some of which are apparent from survey data.

The value of stump treatments varied with the chemical used (Table 2). There is little doubt that stump treatments with urea, and especially borax, were effective in reducing losses from annosus root rot. The sample of zinc chloride treated plantations was small, but it suggests that the chemical is ineffective. The data for creosote are misleading because stumps in the three Massachusetts plantations were not treated until three months after thinning, and not all stumps were treated. Creosote treatments in Rhode Island produced inconsistent results.

Comparison of chemical stump treatments is most meaningful in the data from PWSB. Urea, borax, and creosote have been used in PWSB plantations. Borax has been the most effective material. Treated plantations had much less mortality per acre than untreated ones.

F. annosus mortality is not normally expected to occur in New England until approximately four years after thinning. The mortality rate remains high for a period but declines after about twelve years and may eventually stop. These observations were borne out by the survey (Table 3). Mortality was very light in the first four years, but it then increased. The largest increase occurred 8-10 years following thinning, and it then slowed. The increase can be determined by subtracting the mortality figure for the preceeding period from that of the period in question. Thus, from "total New England", by subtracting 1.3 from 4.8 it can be seen that 3.5 trees died per acre in the 8-10 year period following thinning.

Relationships between other factors and annosus root rot incidence were also considered. These other factors included: different thinning methods, number of thinnings, topography, site moisture, basal area, spacing, plantation age, and stand vigor. However, the effects of these factors on disease incidence were indefinite because of inconclusive data or complicating variables. Chemical stump treatments were often a complicating factor.

DISCUSSION

The incidence of Fomes annosus increases with increasing planting and thinning of susceptible conifers. The availability of markets plays an important role in this relationship. A reliable market stimulates active, continuous thinnings. The situation at PWSB illustrates this point. Here, there are over 150 plantations on approximately 13,000 acres. A nearby pulp mill provided a market for material removed in thinnings. Thinning began at the PWSB in 1946 and has continued almost yearly to the present. There was

little mortality associated with the early thinnings, but plantations thinned in the late 1950's were often severely infected. The beginning of stump treatments in 1960 has helped prevent additional losses.

In contrast to the PWSB, plantations in Maine, New Hampshire, and Vermont are widely scattered. Markets are somewhat less accessible, so there has been less thinning in these states. There is also less annosus root rot.

There is much information concerning the merits of different stump treatment materials. This survey demonstrates the value of borax in particular. It is effective when properly applied and is inexpensive. Cost estimates for the material and its application vary from 1/5 to 1/2 cent per stump. Borax is currently the only chemical with federal registration for treating stumps to control F. annosus.

When treating stumps with borax, the material should be sprinkled on immediately after cutting. Too long a time lapse between cutting and borax application allows infection and penetration by the fungus beyond the effective range of the chemical. The entire cut surface of the stump should be lightly covered. An easy application method involves drilling holes in a jar top making a sprinkler in the fashion of a salt shaker.

Urea has several disadvantages. It has not proven as effective as borax. When used in liquid formulation, it is unwieldy and inconvenient to apply. When used dry, the prills roll off the stump providing incomplete coverage. Tests with creosote have yielded varying results. It is messy and seals the tops of stumps preserving the roots below. Zinc chloride is ineffective and preserves the stumps and roots. Stumps treated with zinc chloride are rock-hard several years later.

In the Southeastern United States, chemical stump treatments are not recommended in stands where F. annosus already occurs. It is feared that treatment may reduce the activity of competitive microorganisms thus allowing more extensive colonization of already infected roots. Results of this survey indicate that this may not be true in northern plantations. For example, PWSB stands which were infected during previous

thinnings and which received borax treatments in subsequent thinnings had an average of only one-fourth as much mortality as infected stands which received no stump treatments in subsequent thinnings. It seems that if no stump treatments are used in infected stands, the chance of widespread infection of fresh stumps is great because of an existing abundance of inoculum in the plantation. Mortality from new infection without borax treatment is greater than that possibly arising from increased colonization of already infected stumps with borax treatment.

Whether F. annosus causes serious impact in New England has been questioned. An average accumulative mortality of 2.8 trees per acre is not high and indicates that annosus root rot is not serious on a broad scale. On an individual plantation or ownership basis, however, the question of impact can be quite different. But even here, a number of variables are involved, and losses which are tolerable to one owner may be unacceptable to another. Losses can be minimized by proper use of stump treatments. To treat or not is a management decision which must be left to the discretion of the individual owner or manager. Technical advice is available from State forest pest control specialists or from the Portsmouth Field Office, State and Private Forestry.

ACKNOWLEDGEMENTS

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Rhode Island	-	Hans Bergey, Phillip Verrier
Vermont	-	Elwin Leysath, E. Bradford Walker

In addition, many others assisted in supplying lists of plantations to State Forester's offices.

A P P E N D I X

TABLE 1

ANNOSUS ROOT ROT IN THINNED
NEW ENGLAND PLANTATIONS

LOCATION	AVERAGE NO. DEAD TREES PER ACRE	INFECTED PLANTATIONS/ TOTAL NO. PLANTATIONS SURVEYED
Rhode Island State	11.2	7/8
Providence Water Supply Board	2.7	58/76
Total Rhode Island	3.5	65/84
Connecticut	2.4	18/29
Massachusetts	8.2	11/12
Vermont	0.4	7/19
New Hampshire	2.9	3/5
Maine	1.4	6/10
Total New England	2.8	110/159

TABLE 2

EFFECTS OF STUMP TREATMENTS ON ANNOSUS ROOT ROT IN NEW ENGLAND PLANTATIONS

LOCATION	UREA	BORAX	CREOSOTE	ZINC CHLORIDE	NO TREATMENT
Rhode Island State	--	--	1.1 (2/2)	--	12.7 (5/6)
Providence Water Supply Board	1.4*(17/24)**	0.6 (10/14)	1.1 (6/6)	--	4.8 (25/32)
Total Rhode Island	1.4 (17/24)	0.6 (10/14)	1.1 (8/8)	--	6.1 (30/38)
Connecticut	0.0 (0/3)	0.0 (0/3)	--	4.6 (3/3)	2.6 (15/20)
Massachusetts	--	--	19.4 (3/3)	--	4.4 (8/9)
Vermont	--	--	--	--	0.3 (7/19)
New Hampshire	--	--	--	--	2.9 (3/5)
Maine	--	--	--	--	1.4 (6/10)
Total New England	1.3 (17/27)	0.5 (10/17)	5.8 (11/11)	4.6 (3/3)	3.0 (69/101)

*Average number of dead trees per acre.
**Infected plantations/total number of plantations surveyed.

TABLE 3

ANNOSUS ROOT ROT IN NEW ENGLAND
PLANTATIONS IN RELATION TO YEARS SINCE LAST THINNING

LOCATION	YEARS SINCE LAST THINNING				
	Less Than 4	4 - 6	6 - 8	8 - 10	More Than 10
Rhode Island State	--	1.1 (1/1)	--	14.1 (5/5)	2.0 (1/2)
Providence Water Supply Board	0.2* (3/6)**	1.0 (12/14)	1.3 (14/22)	2.5 (10/11)	5.3 (19/23)
Total Rhode Island	0.2 (3/6)	1.0 (13/15)	1.3 (14/22)	6.4 (15/16)	5.2 (20/25)
Connecticut	--	1.0 (8/15)	1.7 (3/5)	7.5 (3/4)	5.2 (4/5)
Massachusetts	--	--	--	0.7 (1/2)	11.7 (10/10)
Vermont	0.7 (3/9)	0.2 (2/4)	0.0 (0/1)	2.0 (2/4)	0.0 (0/1)
New Hampshire	--	2.9 (3/5)	--	--	--
Maine	--	2.3 (3/4)	--	0.5 (1/2)	0.6 (2/4)
Total New England	0.6 (6/15)	1.0 (29/43)	1.3 (17/28)	4.8 (22/28)	4.9 (36/45)

*Average number of dead trees per acre
**Infected plantations/total number of plantations surveyed